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SOLAR/2016-79/04

Monthly Performance Report

LOUDOUN COUNTY

APRIL 1979

U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

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MONTHLY PERFORMANCE REPORT

LOUDOUN COUNTY

APRIL 1979

I. SYSTEM DESCRIPTION

The Loudoun County site is the Charles S. Monroe Vocational Technical School located in Leesburg, Virginia. Solar energy is used for preheating domestic hot water (DHW). The solar energy system has an array of flat-plate collectors with a gross area of 1225 square feet. The array faces 15 degrees west of south at an angle of 37 degrees to the horizontal. A silicone oil solution is the transfer medium that delivers solar energy from the collector array to a heat exchanger. Solar energy is stored within the building in a 2056-gallon water tank.

Preheated water is supplied from the solar storage tank to a 1000-gallon DHW tank. Hot water from the DHW tank is circulated through the service hot water lines and back to the DHW tank to instantly provide hot water at the service taps. This circulation is controlled by a time clock so that circulation occurs only during hours of normal use. An electrical heating element immersed in the DHW tank provides auxiliary energy, as required, to maintain the desired 140°F service water temperature. The system, shown schematically in Figure 1, has four modes of operation, all of which operate independently of one another.

Mode 1 - Collector-to-Storage: This mode activates when there is a temperature difference of 20°F between a control sensor located at the collector and a control sensor located inside the storage tank (near the bottom). At this time the collector turns on pump P1 which circulates the transport fluid through the collectors and the heat exchanger located inside the storage tank. P1 continues to operate until the temperature difference between the control sensors is less than 5°F. At this point P1 turns off and the mode terminates. Mode 1 will also terminate when the storage tank temperature exceeds 200°F, as measured by another control sensor near the top of the storage tank.

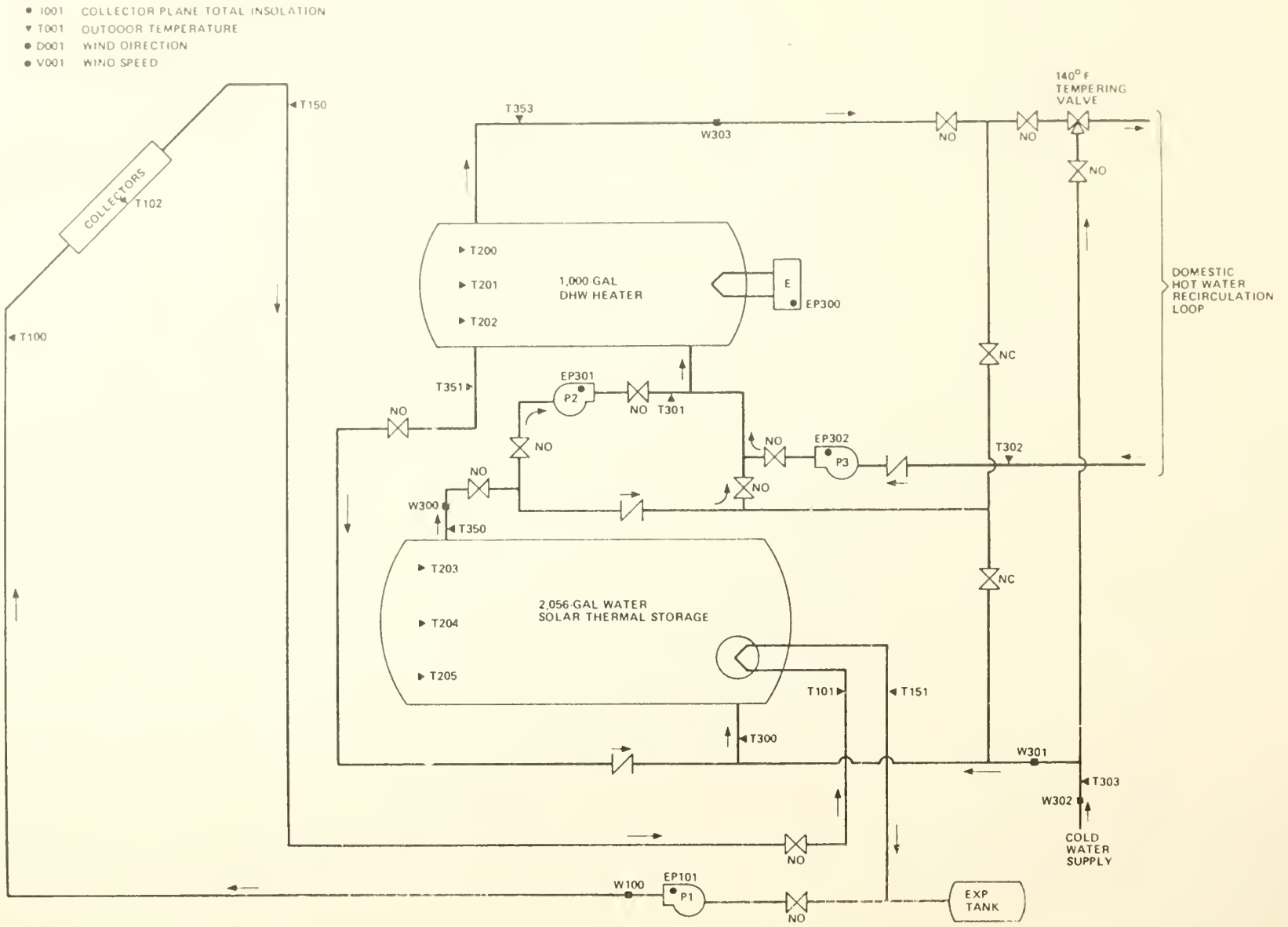

Figure 1. LOUDOUN COUNTY SCHOOL SOLAR ENERGY SYSTEM SCHEMATIC

Mode 2 - Solar Energy Preheat: This mode activates when there is a temperature difference of 20°F between a control sensor located near the top of the storage tank and a control sensor located near the bottom of the DHW tank. At this time the controller energizes pump P2 which delivers preheated water from the storage tank to the DHW tank and recirculates water from the DHW tank to the storage tank. When the temperature difference between the control sensors becomes less than 5°F, pump P2 turns off and the mode terminates. An electrical element in the DHW tank is energized to provide auxiliary water heating when the DHW tank temperature falls below a set point.

Mode 3 - Recirculate: This mode activates (under time-clock control) during hours of normal use, i.e., primarily during daylight and early evening hours every day of the week except Sunday. When activated, pump P3 is energized and hot water circulates from the hot water tank through the service hot water lines and returns to the hot water tank.

Mode 4 - DHW Load: This mode activates when hot water is drawn from any of the hot water taps in the building. The hot water demand is replenished by cold water supplied to the storage tank. The make-up water to the DHW tank from the storage tank goes through P2 (if mode 2 is active at this time) or bypasses P2 if mode 2 is inactive. Mode 3 need not be activated to supply the demand at the hot water taps.

II. PERFORMANCE EVALUATION

INTRODUCTION

The Loudoun County School was in session during the month of April. The solar energy system operated correctly for only the last four days of the month. A collector control sensor malfunction and a human error resulted in improper mode 1 operation during the remainder of the month. In addition, incorrect

wiring of the mode 2 controller resulted in improper mode 2 operation during part of April. These two situations impacted collector and storage performance factors and are discussed in the "Observations" section below. Solar energy satisfied 37 percent of DHW requirements. The solar energy system provided electrical energy savings of 3.3 million Btu. The performance factors are discussed below and presented in the accompanying report forms.

WEATHER CONDITIONS

During the month, total incident solar energy on the collector array was 45.4 million Btu for a daily average of 1235 Btu per square foot. This was below the estimated average daily solar radiation for this geographical area during April of 1494 Btu per square foot for a plane facing 15 degrees west of south with a tilt of 37 degrees to the horizontal. The average ambient temperature during April was 52°F as compared with the long-term average for April of 53°F.

THERMAL PERFORMANCE

System - During April the solar energy system performed somewhat poorer than expected. The expected performance was determined from a modified f-chart analysis using measured weather and subsystem loads as inputs. Solar energy collected was 9.3 million Btu versus an estimated 9.0 million Btu. Solar energy used by the system was estimated by assuming that all energy collected would be applied to the load. Actual solar energy used was 4.1 million Btu. System total solar fraction was 37 percent versus an estimated 79 percent.

Collector - The total incident solar radiation on the collector array for the month of April was 45.4 million Btu. During the period the collector loop was operating, the total insolation amounted to 40.6 million Btu. The net collected solar energy for the month of April was 9.3 million Btu, resulting in a collector array efficiency of 21 percent, based on total incident insolation. Net solar energy delivered from the collector array to

storage was 5.5 million Btu. Energy loss during transfer from the collector array to storage was 3.9 million Btu. This loss represented 41 percent of the energy collected. Operating energy required by the collector loop was 0.69 million Btu. Additional discussion of collector performance is included in the "Observations" section below.

Storage - Net solar energy delivered to storage was 5.5 million Btu. There were 4.1 million Btu delivered from storage to the DHW subsystem. Energy loss from storage was 0.95 million Btu. This loss represented 17 percent of the energy delivered to storage. The storage efficiency was 83 percent: This is calculated as the ratio of the sum of the energy removed from storage and the change in stored energy, to the energy delivered to storage. The average storage temperature for the month was 106°F.

DHW Load - The DHW subsystem consumed 4.1 million Btu of solar energy and 7.4 million Btu of auxiliary electrical energy to satisfy a hot water load of 5.6 million Btu. The solar fraction of this load was 37 percent. Losses from the DHW subsystem were 5.9 million Btu. The DHW subsystem consumed a total of 0.22 million Btu of operating energy, resulting in an electrical energy savings of 4.0 million Btu. A daily average of 338 gallons of DHW was consumed at an average temperature of 122°F delivered from the tank.

OBSERVATIONS

The data presented above for solar energy collected and solar energy delivered from the collector array to storage represents net energy collected/delivered for the month. The combination of the collector control sensor malfunction and a human error which kept the collecter controller switch in the "manual run" position resulted in mode 1 being activated continuously for the first 23 days of the month. Therefore, a portion of the solar energy collected and delivered to storage during good insolation periods was delivered from storage back to the collector array and radiated to the outside ambient during periods of low insolation and during the nondaylight hours. This explains the negative values for collected solar energy on seven days in

April. Mode 1 was deactivated on April 23 when the controller switch was turned to the "off" position. The collector control sensor was replaced on April 24 but the collector controller switch was not put into the automatic position until midday on April 26. Therefore, mode 1 operated automatically for only the last four days of the month. Analysis shows that 14.5 million Btu of solar energy were collected which indicates that 5.2 million Btu were radiated to the outside ambient by the collector array because of the collector control anomalies during the month. Analysis also shows that 8.8 million Btu were delivered from storage to the collected loop during the month because of these anomalies.

During the four-day period in which mode 1 operated correctly, 2.2 million Btu of solar energy were collected, of which 1.8 million Btu were delivered to storage. Collector efficiency for this period was 31 percent and storage efficiency was 74 percent.

Prior to April 26, the controller for pump P2 was incorrectly wired and resulted in mode 2 being as activated only when the DHW heater temperature exceeded the thermal storage temperature. This resulted in energy transfers from the DHW tank to the storage tank rather than in the opposite (and normal) direction. The mode 2 controller was in the "off" position for most of this time. However, the controller was in the automatic position on April 3, 4, 13, 14, and 25. This accounts for the negative values of energy from storage and solar energy used in the tabulated data. The controller wiring was corrected on April 26 and mode 2 is now operating correctly.

A total of 4.1 million Btu were lost in the service hot water lines during mode 3 operation. This represents 71 percent of the losses in the hot water subsystem.

ENERGY SAVINGS

The solar energy system provided a total electrical energy savings of 3.3 million Btu. The DHW subsystem provided an electrical energy savings of 4.0 million Btu.

III. ACTION STATUS

A malfunctioning sensor (W302) must be replaced by IBM pending NASA approval. No date has been scheduled for this replacement.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: LOUDOUN COUNTY
REPORT PERIOD: APRIL,1979

SOLAR/2016-79/04

SITE/SYSTEM DESCRIPTION:
THE LOUDOUN COUNTY SOLAR ENERGY SYSTEM PROVIDES DOMESTIC HOT WATER PREHEATING FOR THE CHARLES S. MONROE VOCATIONAL TECHNICAL SCHOOL. THE FLAT PLATE COLLECTOR ARRAY HAS A GROSS AREA OF 1225 SQ FT. SOLAR ENERGY STORAGE CONSISTS OF A 2056 GAL WATER TANK WHICH SERVES AS A PREHEAT TANK FOR THE HOT WATER SUPPLY. A 1000 GALLON STORAGE WATER HEATER IS SUPPLIED FROM THE PREHEAT TANK AND CONTAINS AN ELECTRIC AUXILIARY HEATING ELEMENT TO PROVIDE SUPPLEMENTAL HEATING AS REQUIRED.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	45.402 MILLION BTU
	37063 BTU/SQ.FT.
COLLECTED SOLAR ENERGY	9.318 MILLION BTU
	7607 BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	52 DEGREES F
AVERAGE BUILDING TEMPERATURE	N.A. DEGREES F
ECSS SOLAR CONVERSION EFFICIENCY	0.09
ECSS OPERATING ENERGY	0.685 MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	0.900 MILLION BTU
TOTAL ENERGY CONSUMED	17.604 MILLION BTU

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	5.620	N.A.	N.A.	5.620 MILLION BTU
SOLAR FRACTION	37	N.A.	N.A.	37 PERCENT
SOLAR ENERGY USED	4.124	N.A.	N.A.	4.124 MILLION BTU
OPERATING ENERGY	0.215	N.A.	N.A.	0.900 MILLION BTU
AUX. THERMAL ENERGY	7.386	N.A.	N.A.	7.386 MILLION BTU
AUX. ELECTRIC FUEL	7.386	N.A.	N.A.	7.386 MILLION BTU
AUX. FOSSIL FUEL	N.A.	N.A.	N.A.	N.A. MILLION BTU
ELECTRICAL SAVINGS	4.033	N.A.	N.A.	3.348 MILLION BTU
FOSSIL SAVINGS	N.A.	N.A.	N.A.	N.A. MILLION BTU

SYSTEM PERFORMANCE FACTOR: 0.204

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978. SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: LOUDOUN COUNTY
REPORT PERIOD: APRIL,1979

SOLAR/2016-79/04

SITE/SYSTEM DESCRIPTION:
THE LOUDOUN COUNTY SOLAR ENERGY SYSTEM PROVIDES DOMESTIC HOT WATER PREHEATING FOR THE CHARLES S. MONROE VOCATIONAL TECHNICAL SCHOOL. THE FLAT PLATE COLLECTOR ARRAY HAS A GROSS AREA OF 1225 SQ FT. SOLAR ENERGY STORAGE CONSISTS OF A 2056 GAL WATER TANK WHICH SERVES AS A PREHEAT TANK FOR THE HOT WATER SUPPLY. A 1000 GALLON STORAGE WATER HEATER IS SUPPLIED FROM THE PREHEAT TANK AND CONTAINS AN ELECTRIC AUXILIARY HEATING ELEMENT TO PROVIDE SUPPLEMENTAL HEATING AS REQUIRED.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	47.899	GIGA JOULES
	420890	KJ/SQ.M.
COLLECTED SOLAR ENERGY	9.831	GIGA JOULES
	86381	KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	11	DEGREES C
AVERAGE BUILDING TEMPERATURE	N.A.	DEGREES C
DOSS SOLAR CONVERSION EFFICIENCY	0.09	
DOSS OPERATING ENERGY	0.723	GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	0.949	GIGA JOULES
TOTAL ENERGY CONSUMED	18.572	GIGA JOULES

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	5.929	N.A.	N.A.	5.929 GIGA JOULES
SOLAR FRACTION	37	N.A.	N.A.	37 PERCENT
SOLAR ENERGY USED	4.350	N.A.	N.A.	4.350 GIGA JOULES
OPERATING ENERGY	0.226	N.A.	N.A.	0.949 GIGA JOULES
AUX. THERMAL ENG	7.792	N.A.	N.A.	7.792 GIGA JOULES
AUX. ELECTRIC FUEL	7.792	N.A.	N.A.	7.792 GIGA JOULES
AUX. FOSSIL FUEL	N.A.	N.A.	N.A.	N.A. GIGA JOULES
ELECTRICAL SAVINGS	4.255	N.A.	N.A.	3.533 GIGA JOULES
FOSSIL SAVINGS	N.A.	N.A.	N.A.	N.A. GIGA JOULES

SYSTEM PERFORMANCE FACTOR: 0.204

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: LOUDOUN COUNTY
REPORT PERIOD: APRIL,1979

SOLAR/2016-79/04

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	0.774	60	0.001	0.000	0.029	N	0.001
2	0.111	50	0.168	0.000	0.030	O	1.509
3	0.216	48	-0.082	0.000	0.030	T	-0.378
4	0.046	41	-0.448	0.000	0.029		-9.651
5	2.099	47	0.018	0.000	0.029	A	0.009
6	2.933	42	0.423	0.000	0.029	P	0.144
7	2.843	39	0.007	0.000	0.029	P	0.002
8	1.498	45	0.000	0.000	0.029	L	0.000
9	0.148	39	0.329	0.000	0.030	I	2.226
10	2.840	46	0.397	0.000	0.030	C	0.140
11	2.520	53	0.481	0.000	0.029	A	0.191
12	0.597	52	0.620	0.000	0.029	B	1.038
13	0.158	45	-0.386	0.000	0.029	L	-2.442
14	2.335	49	-0.164	0.000	0.029	E	-0.070
15	1.192	51	0.005	0.000	0.029		0.004
16	0.725	47	0.000	0.000	0.029		0.000
17	1.716	50	0.217	0.000	0.029		0.127
18	2.546	53	0.249	0.000	0.029		0.098
19	2.820	54	0.338	0.000	0.029		0.120
20	2.641	53	0.471	0.000	0.029		0.178
21	2.660	59	0.000	0.000	0.029		0.000
22	1.457	62	0.000	0.000	0.028		0.000
23	0.679	65	0.338	0.000	0.013		0.497
24	0.503	61	0.298	0.000	0.001		0.593
25	1.982	68	-0.072	0.000	0.000		-0.036
26	0.259	60	0.148	0.000	0.000		0.571
27	1.121	60	0.276	0.000	0.006		0.246
28	1.640	53	0.000	0.000	0.008		0.000
29	1.781	49	0.026	0.000	0.008		0.015
30	2.563	58	0.465	0.000	0.010		0.181
SUM	45.402	-	4.124	0.000	0.685	N.A.	-
AVG	1.513	52	0.137	0.000	0.023	N.A.	0.091
NBS ID	0001	N113			G102		N111

* DENOTES UNAVAILABLE DATA.
á DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: LOUDOUN COUNTY
REPORT PERIOD: APRIL,1979

SOLAR/2016-79/04

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	0.774	0.774	0.124	64	0.160
2	0.111	0.111	-0.058	50	-0.520
3	0.216	0.216	-0.049	49	-0.225
4	0.046	0.046	-0.334	41	-7.203
5	2.099	2.099	0.413	*	0.197
6	2.933	2.933	0.698	43	0.238
7	2.843	2.843	0.574	44	0.202
8	1.498	1.498	0.088	50	0.059
9	0.148	0.148	-0.199	39	-1.343
10	2.840	2.840	0.966	53	0.340
11	2.520	2.520	0.810	64	0.321
12	0.597	0.597	0.150	*	0.252
13	0.158	0.158	-0.242	46	-1.528
14	2.335	2.335	0.521	56	0.223
15	1.192	1.192	0.027	54	0.023
16	0.725	0.725	-0.043	50	-0.059
17	1.716	1.716	0.382	55	0.223
18	2.546	2.546	0.745	*	0.293
19	2.820	2.820	0.828	61	0.294
20	2.641	2.641	0.820	63	0.311
21	2.660	2.660	0.703	73	0.264
22	1.457	1.457	0.220	67	0.151
23	0.679	0.142	-0.059	69	-0.087
24	0.503	0.040	0.026	*	0.051
25	1.982	0.000	0.000	78	0.000
26	0.259	0.007	0.002	62	0.007
27	1.121	0.674	0.317	65	0.283
28	1.640	1.376	0.573	66	0.350
29	1.781	1.274	0.396	*	0.222
30	2.563	2.187	0.915	70	0.357
SUM	45.402	40.573	9.318	-	-
AVG	1.513	1.352	0.311	57	0.205
RESID	G001		Q100		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCE

SITE: LOUDOUN COUNTY
REPORT PERIOD: APRIL, 1979

SOLAR/2016-79/04

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	-0.037	0.001	0.011	101	-0.338
2	-0.119	0.168	-0.246	93	0.656
3	-0.156	-0.082	0.060	85	0.136
4	-0.546	-0.448	0.063	89	0.705
5	0.214	0.018	0.154	98	0.805
6	0.543	0.423	0.088	107	0.940
7	0.419	0.007	0.270	118	0.661
8	-0.117	0.000	-0.085	123	0.724
9	-0.232	0.329	-0.429	105	0.430
10	0.785	0.397	0.174	100	0.729
11	0.679	0.481	0.057	106	0.791
12	0.075	0.620	-0.429	93	2.548
13	-0.299	-0.386	0.228	86	0.530
14	0.310	-0.164	0.352	106	0.605
15	-0.115	0.005	-0.105	114	0.872
16	-0.161	0.000	-0.105	107	0.655
17	0.249	0.217	-0.029	104	0.757
18	0.553	0.249	0.218	110	0.844
19	0.636	0.338	0.059	117	0.624
20	0.623	0.471	0.041	121	0.822
21	0.453	0.000	0.264	131	0.581
22	0.011	0.000	-0.055	136	-4.856
23	-0.140	0.338	-0.446	119	0.771
24	0.018	0.298	-0.300	98	-0.086
25	0.000	-0.072	0.142	88	1.000
26	-0.002	0.148	-0.152	93	1.771
27	0.263	0.276	0.009	87	1.079
28	0.485	0.000	0.344	98	0.709
29	0.299	0.026	0.147	113	0.577
30	0.775	0.465	0.089	121	0.716
SUM	5.465	4.124	0.389	-	-
AVG	0.182	0.137	0.013	106	0.826
NBS ID	Q200	Q201	Q202		N108

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
HOT WATER SUBSYSTEM

SITE: LOUDOUN COUNTY
REPORT PERIOD: APRIL,1979

SOLAR/2016-79/04

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR FR.OF LOAD PER CENT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	0.000	0	0.001	0.000	0.026	0.026	N	0.001	N	60	140	0
2	0.178	34	0.168	0.005	0.246	0.246	O	0.168	O	57	125	318
3	0.187	37	-0.082	0.012	0.353	0.353	T	-0.088	T	58	121	335
4	0.360	-41	-0.448	0.030	0.925	0.925		-0.472		58	113	675
5	0.321	-61	0.018	0.020	0.605	0.605	A	0.003	A	58	120	573
6	0.322	33	0.423	0.005	0.227	0.227	P	0.423	P	58	120	563
7	0.002	38	0.007	0.005	0.223	0.223	P	0.007	P	70	118	5
8	0.000	24	0.000	0.000	0.027	0.027	L	0.000	L	73	122	1
9	0.228	41	0.329	0.005	0.195	0.195	I	0.329	I	69	125	390
10	0.379	62	0.397	0.005	0.209	0.209	C	0.397	C	55	123	653
11	0.418	66	0.481	0.005	0.240	0.240	A	0.481	A	54	121	735
12	0.483	76	0.620	0.005	0.190	0.190	B	0.620	B	56	123	851
13	0.003	45	-0.386	0.016	0.471	0.471	L	-0.397	L	69	121	6
14	0.000	-92	-0.164	0.017	0.483	0.483	E	-0.176	E	70	116	1
15	0.000	-44	0.005	0.000	0.031	0.031		0.005		71	127	1
16	0.001	-27	0.000	0.005	0.219	0.219		0.000		72	125	3
17	0.176	13	0.217	0.005	0.202	0.202		0.217		61	122	310
18	0.261	36	0.249	0.005	0.190	0.190		0.249		59	121	477
19	0.305	52	0.338	0.005	0.156	0.156		0.338		61	123	544
20	0.316	69	0.471	0.005	0.147	0.147		0.471		61	122	555
21	0.010	62	0.000	0.005	0.174	0.174		0.000		66	120	21
22	0.003	43	0.000	0.000	0.028	0.028		0.000		70	125	6
23	0.222	57	0.338	0.005	0.115	0.115		0.338		63	122	395
24	0.215	68	0.298	0.005	0.120	0.120		0.298		62	121	395
25	0.387	57	-0.072	0.016	0.531	0.531		-0.083		61	120	744
26	0.334	-7	0.148	0.009	0.446	0.446		0.144		61	120	643
27	0.297	39	0.276	0.005	0.285	0.285		0.276		63	122	548
28	0.000	0	0.000	0.005	0.202	0.202		0.000		71	127	0
29	0.000	0	0.026	0.001	0.035	0.035		0.025		71	127	0
30	0.212	47	0.465	0.009	0.085	0.085		0.461		62	124	389
SUM	5.620	-	4.124	0.215	7.386	7.386	N.A.	4.033	N.A.	-	-	10137
AVG	0.187	37	0.137	0.007	0.246	0.246	N.A.	0.134	N.A.	63	122	338
NBS	Q302	N300	Q300	Q303	Q301	Q305	Q306	Q311	Q313	N305	N307	N308

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE: LOUDOUN COUNTY
REPORT PERIOD: APRIL, 1979

SOLAR/2016-79/04

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	632	N	60	64	N	0	2
2	91	O	50	50	O	85	3
3	176	T	48	49	T	0	2
4	38		41	41		23	3
5	1713	A	47	*	A	266	4
6	2394	F	42	43	P	262	11
7	2321	P	39	44	P	287	6
8	1223	L	45	50	L	146	2
9	121	I	39	39	I	285	6
10	2318	C	46	53	C	285	5
11	2057	A	53	64	A	0	1
12	487	E	52	*	B	0	1
13	129	L	45	46	L	48	5
14	1906	E	49	56	E	311	2
15	973		51	54		275	5
16	592		47	50		276	4
17	1401		50	55		304	5
18	2079		53	*		306	6
19	2302		54	61		317	4
20	2156		53	63		*	1
21	2171		59	73		*	1
22	1190		62	67		0	0
23	554		65	69		0	1
24	410		61	*		0	1
25	1618		68	78		152	3
26	212		60	62		0	1
27	915		60	65		*	2
28	1339		53	66		0	2
29	1454		49	*		289	2
30	2092		58	70		0	2
SUM	37063	N.A.	-	-	-	-	-
AVG	1235	N.A.	52	57	N.A.	303	3
NBS ID	QC01		N113			N115	N114

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